PATENT ABSTRACTS OF JAPAN

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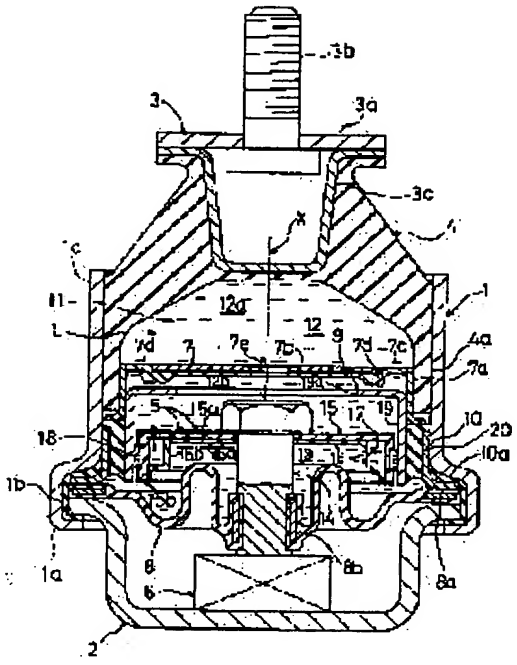
(54) VIBRATION ISOLATING MOUNT DEVICE

(57)Abstract:
PURPOSE: To effectively damp vibration in a wide frequency region and prevent excessive liquid pressure from acting upon a partition body at the input time of large impact force.
CONSTITUTION: A support cylinder body 1 is disposed with the upper part facing the vibration generating source side and with the lower part facing the vibration receiving part side. The support cylinder body 1 is connected to an upper fitting member 3, connected to the vibration generating source side, by an elastic support body 4. A lower fitting member 2 connected to the vibration receiving part side is connected to the lower part of the support cylinder body 1. Liquid L is filled into a liquid chamber 11 partitioned by the elastic support body 4 and the support cylinder body 1. A partition body 5 for partitioning the liquid chamber 11 into a pressure chamber 12 and a balance chamber 13 is disposed in such a way as to be relatively movable in the vertical direction in relation to the support cylinder body 1. The partition body 5 is provided with a limiting passage 17 for communicating the pressure chamber 12 with the balance chamber 13. A driving means 6 is direction according to input vibration, and a buffer member 7 partitioning the pressure chamber 12 vertically and having a throttle hole 7e piercing vertically is provided being elastically supported to the support cylinder 1.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The support barrel which turns the direction of cylinder axis 1 side-edge section to an oscillating generation source side, turns the other side edge section to an oscillating receiving part side, respectively, and is arranged, The 1st attachment member which is arranged at this support barrel top Norikazu side edge section, and is connected with the above-mentioned oscillating generation source side, The annular elastic bearing object which connects mutually this 1st attachment member and the 1 side edge section of the above-mentioned support barrel, The 2nd attachment member which is connected with the side edge section besides the above of the above-mentioned support barrel, and is connected with the above-mentioned oscillating receiving part side, The liquid room where partition formation was carried out by the above-mentioned elastic bearing object and the above-mentioned support barrel, and the liquid was enclosed, The batch object which divided this liquid room in the above-mentioned cylinder-axis direction at the pressurized room and the balanced room, and has been arranged possible [relative displacement] in the above-mentioned cylinder-axis direction to the inner skin of the above-mentioned support barrel, Vibrationproofing mounting equipment characterized by having the limit path which is established in this batch object and opens the above-mentioned pressurized room and a balanced room for free passage mutually, and the driving means which carries out the forcible excitation of the above-mentioned batch object according to input vibration in the above-mentioned cylinder-axis direction.
[Claim 2] It is vibrationproofing mounting equipment according to claim 1 with which the buffer member which divides this pressurized room in the direction of a cylinder axis at the two pressurized-room sections is prepared in the pressurized room between a batch object and the 1st attachment member, and the diaphragm hole which this buffer member is supported possible [displacement] in the direction of a cylinder axis by fluid pressure fluctuation in a pressurized room to the inner skin of a support barrel, and opens the two above-mentioned pressurized-room sections for free passage to the buffer member of a parenthesis is formed.
[Claim 3] Vibrationproofing mounting equipment according to claim 2 with which the buffer member has the bellows cylinder part which was suitable in the direction of a cylinder axis, and is supported by the inner skin of a support barrel through this bellows cylinder part.

[Translation done.]

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention is used for mounting of car motor etc., and relates to the vibrationproofing mounting equipment which demonstrates a damping effect to vibration of a broad frequency domain.
[0002]
[Description of the Prior Art] The attachment member currently steadily connected with the engine side which is an oscillating generation source as this kind of vibrationproofing mounting equipment from before, The liquid room formed between the attachment members of another side connected with the car-body side which supports this engine By dividing into two liquid chamber portions with a batch object in the mid-position of the principal-vibration input direction, and making adjustable opening area of the limit path which opens these two liquid chamber portions of each other for free passage What enabled both attenuation of vibration of a mutually different frequency is known (for example, refer to JP,1-158243,A). The amount of the above-mentioned opening of openings enlarges, so that the frequency of input vibration becomes large by opening of the sector in which the means which makes opening area of a limit path adjustable was formed by the above-mentioned batch object, and the rotation plate to which the amount of openings of the above-mentioned opening changes by carry out relative rotation to this batch object constitute from this thing, and control the rotation drive of this rotation plate.
[0003]
[Problem(s) to be Solved by the Invention] However, in the above-mentioned conventional vibrationproofing mounting equipment, since a means to change the opening area of a limit path is constituted by opening and the rotation plate, a max side has a limit noting that it writes also the min side of opening area, and, thereby, there is a limitation in the periodic damping by the side of a RF. Therefore, there is a problem that the possible frequency domain of periodic damping can seldom be set to a RF side. For this reason, when using as engine-mount equipment for automobiles, it has the fault that the fluctuation field of that engine speed is very large, and can decrease effectively no vibration generated in that very large frequency domain. Moreover, when there is an input of large impulse force, the excessive fluid pressure accompanying a rapid fluid pressure rise acts on the above-mentioned batch object, and there is a possibility of causing the fall of the dependability of actuation of the above-mentioned rotation plate or the fall of the endurance of a batch object.
[0004] This invention is made in view of such a situation, and the place made into the purpose is to decrease all vibration in a broad frequency domain effectively. Moreover, the place made into other purposes is to prevent that fluid pressure excessive at the time of the input of large impulse force acts on a batch object.
[0005]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, invention according to claim 1 The support barrel which turns the direction of cylinder axis 1 side-edge section to an oscillating generation source side, turns the other side edge section to an oscillating receiving part side, respectively, and is arranged, The 1st attachment member which is arranged at this support barrel top Norikazu side edge section, and is connected with the above-mentioned oscillating generation source side, The annular elastic bearing object which connects

mutually this 1st attachment member and the 1 side edge section of the above-mentioned support barrel, It has the liquid room where partition formation was carried out by the 2nd attachment member which is connected with the side edge section besides the above of the above-mentioned support barrel, and is connected with the above-mentioned oscillating receiving part side, and the above-mentioned elastic bearing object and the above-mentioned support barrel, and the liquid was enclosed. In this thing, the batch object which divided the above-mentioned liquid room in the above-mentioned cylinder-axis direction at the pressurized room and the balanced room, and has been arranged possible [relative displacement] in the above-mentioned cylinder-axis direction to the inner skin of the above-mentioned support barrel is established, and the limit path which opens the above-mentioned pressurized room and a balanced room for free passage mutually on this batch object is prepared. And it considers as a configuration equipped with the driving means which carries out the forcible excitation of the above-mentioned batch object according to input vibration in the above-mentioned cylinder-axis direction.

[0006] Moreover, invention according to claim 2 prepares the buffer member which divides this pressurized room into the pressurized room between a batch object and the 1st attachment member in the direction of a cylinder axis at the two pressurized-room sections in invention of the claim 1 above-mentioned publication. And it considers as the configuration which forms the diaphragm hole which this buffer member is made to support in the direction of a cylinder axis possible [displacement] by fluid pressure fluctuation in a pressurized room to the inner skin of a support barrel, and opens the two above-mentioned pressurized-room sections for free passage to the buffer member of a parenthesis.

[0007] Furthermore, in invention of the claim 2 above-mentioned publication, invention according to claim 3 has the bellows cylinder part by which the buffer member was suitable in the direction of a cylinder axis, and is taken as the configuration which makes the inner skin of a support barrel support the above-mentioned buffer member through this bellows cylinder part.

[0008]

[Function] By invention according to claim 1, since compulsion excitation of the batch object which has a limit path is carried out in the principal-vibration input direction by the above-mentioned configuration according to input vibration by the driving means, the resonance frequency of the liquid column through a limit path changes according to input vibration, and the liquid column resonance corresponding to the input vibration is obtained by it. For this reason, an effective damping effect is acquired to input vibration of a broad frequency domain. And also to high frequency oscillation from which the above-mentioned limit path will be in a blinding condition, the fluid pressure rise in a pressurized room is controlled by the forced oscillation of the above-mentioned batch object, and reduction of transmissibility of vibration is achieved.

[0009] Moreover, in invention according to claim 2, even if it is going to raise the fluid pressure of the 1st pressurized-room section through the 1st attachment member in addition to the operation by invention of the claim 1 above-mentioned publication Since elastic support of the buffer member is carried out to the inner skin of a support barrel, while this buffer member displaces and the rise of the above-mentioned fluid pressure is controlled Since it is transmitted where fluctuation of fluid pressure is narrowed down to the 2nd pressurized-room section which is the above-mentioned batch object side through the drawing hole of the above-mentioned buffer member, the effect of the fluid pressure rise by the above-mentioned impulse force does not get across to the above-mentioned batch object directly.

[0010] Furthermore, in invention according to claim 3, since it has the bellows cylinder part by which the buffer member was extended in the direction of a cylinder axis in addition to the operation by invention of the claim 2 above-mentioned publication, absorption of the fluid pressure rise at the time of the above-mentioned large impact input is promoted more by telescopic motion of this bellows cylinder part.

[0011]

[Example] Hereafter, the example of this invention is explained based on a drawing.

[0012] the vibrationproofing mounting equipment which drawing 1 requires for the 1st example of this invention -- being shown -- 1 -- a cylinder axis X -- the principal-vibration input direction

(the vertical direction of drawing 1 --) The support barrel which turned to only calling it the vertical direction hereafter, the lower attachment member of the shape of a cup which is the 2nd attachment member with which 2 stops the lower limit opening side of this support barrel 1, The up attachment member which 3 is a location by the side of upper limit opening of the above-mentioned support barrel 1, and is the 1st attachment member arranged on the above-mentioned cylinder axis X, The driving means to which the annular elastic bearing object with which 4 connects mutually this up attachment member 3 and the above-mentioned support barrel 1, and 5 carry out this batch object 5 at a batch object, and 6 carries out an excitation drive in the vertical direction, and 7 are wrap tabular buffer members about the upper part location of the above-mentioned batch object 5.

[0013] The above-mentioned support barrel 1 and the lower attachment member 2 of each other are connected by caulking section 1a constituted by the lower limit edge of the support barrel 1, and the cylinder-like-object-with-base-like support frame is constituted by these both 1 and 2. Vulcanization adhesion of the rubber thin film 1b is carried out at the inner skin of the above-mentioned caulking section 1a, and the seal in the above-mentioned caulking section 1a is performed by this rubber thin film 1b. To above-mentioned caulking section 1a, with the periphery edge of the above-mentioned lower attachment member 2, moreover, the periphery edge of the doughnut-like diaphram 8 made from a rubber thin film, Location immobilization of the periphery marginal 10a of the periphery cylinder part material 10 which constitutes the maintenance barrel 9 is carried out in the condition of having piled up mutually, Liquid L is enclosed with the closed space formed by the above-mentioned diaphram 8, the above-mentioned elastic bearing object 4, and the support barrel 1, and the liquid room 11 is formed in it. And this liquid room 11 is divided into two with the above-mentioned batch object 5, a pressurized room 12 is formed in this batch object 5 bottom, and the balanced room 13 is formed in the bottom, respectively.

[0014] The above-mentioned support barrel 1 or the lower attachment member 2 is held in the part which is inner-**(ed) by the bracket which is not illustrated and projects in a periphery side by the above-mentioned caulking section 1a, and is connected for example, with the car-body side which is an oscillating receiving part. Moreover, the above-mentioned driving means 6 is formed in the center section of the near field of the above-mentioned balanced room 13 of the above-mentioned lower attachment member 2, and the rod 14 connected to this driving means 6 penetrates the above-mentioned diaphram 8 along with a cylinder axis X, and is extended up. And the above-mentioned batch object 5 is being fixed to the upper limit location of this rod 14. In addition, as for the inside 8a and 8b of drawing 1 , it is the core material embedded in the inside-and-outside periphery location of the above-mentioned diaphram 8, and the periphery edge of diaphram 8 is certainly held by periphery side core material 8a by the above-mentioned caulking section 1a, and the inner circumference edge of the above-mentioned diaphram 8 is certainly fixed to a predetermined location by inner circumference side core material 8b to the peripheral face of the above-mentioned rod 14.

[0015] The above-mentioned up attachment member 3 consists of plate member 3a, connection bolt 3b which projects up along with the above-mentioned cylinder axis X from this plate member 3a, and cylinder-like-object-with-base member 3c which projects caudad from above-mentioned plate member 3a. And the above-mentioned attachment member 3 is connected for example, with the engine side which is an oscillating generation source side through the above-mentioned connection bolt 3b. Moreover, the above-mentioned elastic bearing object 4 is formed in the shape of a truncated cone by one vulcanization shaping of rubber between the peripheral face of the above-mentioned cylinder part material 3c, and the inner skin of upper limit opening marginal 1c of the above-mentioned support barrel 1, and bearing of the above-mentioned up attachment member 3 is elastically carried out to the above-mentioned support barrel 1 with this elastic body bearing object 4. In addition, rubber thin film 4a which covers the range from the lower limit periphery section of this elastic bearing object 4 to the predetermined location of the inner skin of the above-mentioned support barrel 1 is really formed.

[0016] The plate-like part material 15 and 16 of a pair piles up up and down, and is formed, and the above-mentioned batch object 5 is equipped with the annular limit path 17 formed in the

interior of the periphery section. Namely, disk section 16a which the above-mentioned anapleurum-like member 15 consisted of disk section 15a and peripheral wall section 15b which hangs caudad from the periphery edge of this disk section 15a, and was stuck to the above-mentioned katapleurum-like member 16 on the inferior surface of tongue of the above-mentioned disk section 15a, It becomes the inner skin of the above-mentioned peripheral wall section 15b from peripheral wall section 16b which carries out phase opposite, and the above-mentioned annular limit path 17 is formed of the annular crevice formed in the periphery enclosure of this peripheral wall section 16b. And the end of the above-mentioned limit path 17 is made into the above-mentioned pressurized room 12, opening of the other end is carried out to the above-mentioned balanced room 13, respectively, by liquid column resonance at the time of the liquid L of the above-mentioned pressurized room 12 and the balanced room 13 flowing mutually through this limit path 17, it inputs in the vertical direction, especially subsonic vibration is decreased. Moreover, O ring 18 is attached outside, location immobilization is carried out at the peripheral face of peripheral wall section 15b of the above-mentioned anapleurum-like member 15, and through this O ring 18, the above-mentioned batch object 5 is inner-*******(ed) possible [sliding of the vertical direction], where **** is held to the inner circumference cylinder part material 19 of the above-mentioned maintenance barrel 9.

[0017] The above-mentioned maintenance barrel 9 consists of this inner circumference cylinder part material 19, the above-mentioned periphery cylinder part material 10, and a rubber layer 20 that really connects both by vulcanization adhesion, and when location immobilization of the periphery marginal 10a of the above-mentioned periphery cylinder part material 10 is carried out by caulking section 1a, it is arranged so that the above-mentioned inner circumference cylinder part material 19 may surround the above-mentioned batch object 5. in addition, the upper limit edge of the above-mentioned inner circumference cylinder part material 19 is crooked in the inner direction, only the specified quantity projects, and is carried out, and this protrusion marginal 19a plays the role of the stopper which contacts the 7d of the below-mentioned heights of the above-mentioned buffer member 7, and prevents the variation rate to the lower part beyond it of the above-mentioned buffer member 7.

[0018] the bore of attachment cylinder part 7a by which the above-mentioned buffer member 7 was stuck to the inner skin of the support barrel 1 by pressure through rubber thin film 4a, and this attachment cylinder part 7a -- a predetermined dimension -- it consists of elastic support section 7c which connects mutually substrate section 7b which has a small outer diameter and was positioned in the upper part location of the above-mentioned inner circumference cylinder part material 19, this substrate section 7b, and the above-mentioned attachment cylinder part 7a. This elastic supporter 7c connects the upper limit edge of the above-mentioned attachment cylinder part 7a, and the inferior surface of tongue of substrate section 7b with one by vulcanization adhesion, and 7d of heights which project caudad is formed in the periphery section location by the side of the inferior surface of tongue of the above-mentioned substrate section 7b at the above-mentioned elastic support section 7c and one. And drawing hole 7e of the diameter of predetermined penetrated in the direction of cylinder-axis X is formed in the center section of the above-mentioned buffer member 7, and up pressurized-room section 12a which is the 1st pressurized-room section divided by the above-mentioned buffer member 7 through this drawing hole 7e, and lower pressurized-room section 12b which is the 2nd pressurized-room section are opened for free passage mutually.

[0019] the above-mentioned driving means 6 -- for example, electromagnetism -- it is constituted by the actuator or the electrostrictive actuator, and as shown in drawing 2 , it connects with a controller 21, drives with the control signal from this controller 21, and the above-mentioned rod 14 and the batch object 5 are excited on the predetermined amplitude and a predetermined frequency in the vertical direction. That is, the above-mentioned batch object 5 is made to reciprocate to right reverse without going through stages. The above-mentioned controller 21 consists of control circuit 21a and drive circuit 21b, and this control circuit 21a is connected through the acceleration sensors 22a and 22b and the speed sensor 23, and amplifier 24 of a pair which were formed in the Engine E and car-body B side, respectively. And the amplitude and frequency to which the above-mentioned control circuit 21a should carry out

excitation control of the above-mentioned batch object 5 based on the acceleration detection value from the above-mentioned acceleration sensors 22a and 22b, and the vehicle speed value from the above-mentioned speed sensor 23 It calculates (it is hereafter called the excitation amplitude and an excitation frequency), and it is as in phase as the frequency of input vibration, the excitation signal based on these is outputted to the above-mentioned drive circuit 21b, and this drive circuit 21b drives the above-mentioned driving means 6 in response to the above-mentioned driving signal.

[0020] Hereafter, control by the above-mentioned control circuit 21a is explained based on drawing 3 . This control is started when an engine starts, first, a current vehicle speed value and the acceleration values Xt1 and Xt2 by the side of Engine E and a car body B are inputted at step S1 from the above-mentioned speed sensor and both the acceleration sensors 22a and 22b, and a detection vehicle speed value distinguishes that it is 0 at step S2. When a vehicle speed value is 0 (i.e., when having stopped), a return is carried out, when it is under transit, it is based on the acceleration values Xt1 and Xt2 of the top Norikazu pair in step S3, and it is the frequency ft of a current input vibration. And the amplitude (henceforth an input frequency and the input amplitude) is calculated.

[0021] Next, input frequency ft current [above-mentioned] with step S4 The 1st setting frequency f1 It distinguishes that it is the following. this 1st setting frequency f1 **** -- the resonance frequency of the liquid column through the annular limit path 17 of the batch object 5 sets up -- having -- **** -- this 1st setting frequency f1 He is trying to aim at that attenuation by liquid column resonance which minded the above-mentioned limit path 9c to the input of the subsonic vibration (for example, 11Hz engine shake vibration [before and after] 7Hz by the side of low frequency nearby vibration) of a region. For this reason, the above-mentioned input frequency ft The 1st setting frequency f1 A return is carried out a case below, without controlling (when it is ft <=f1).

[0022] And it is the input frequency ft at the above-mentioned step S4. The above-mentioned 1st setting frequency f1 When large, the input frequency ft is the 2nd setting frequency f2 further at step S5. It distinguishes whether it is small. this 2nd setting frequency f2 **** -- the critical frequency by the side of a RF which makes a blinding condition the limit path 17 of the batch object 5 (for example, 30Hz) sets up -- having -- **** -- this 2nd setting frequency f2 It is made to perform control differ by making it a boundary. namely, the above-mentioned step S5 -- input frequency ft The 2nd setting frequency f2 the excitation amplitude for carrying out excitation control of the batch object 5 by the driving means 6 at step S6, when small (in the case of f1 <ft <f2) -- the above-mentioned input amplitude -- the specified quantity -- a small value is defined and the same value as an input frequency is set to the above-mentioned excitation frequency. And at step S7, it is as in phase as input vibration, and the excitation signal based on this excitation amplitude and an excitation frequency is outputted to the above-mentioned drive circuit 20b. as excitation of the above-mentioned batch object 5 is carried out and it is shown in drawing 4 by this, the last amplitude which is a substantial relative flow of a liquid column is negated by the above-mentioned excitation amplitude from the input amplitude based on the input vibration from the above-mentioned engine E side -- having -- the above-mentioned input amplitude -- the specified quantity -- it is made small. That is, input vibration is absorbed by the excitation of the above-mentioned buffer 5.

[0023] On the other hand, it is the input frequency ft at the above-mentioned step S5. The 2nd setting frequency f2 When it is above, the operation of the excitation amplitude and an excitation frequency is performed like the above-mentioned step S6 at step S8 (when it is f2 <=ft). This operation defines the excitation amplitude which may absorb fluctuation of the fluid pressure in the pressurized room 12 resulting from the above-mentioned input vibration. What is necessary is just to define the value which specifically **(ed) what multiplied the effective piston area of a pressurized room 12 by the above-mentioned input amplitude with the effective piston area of the batch object 5 as excitation amplitude. Moreover, the above-mentioned excitation frequency sets up the same value as an input frequency. And it is as in phase as input vibration, and the excitation signal based on this excitation amplitude and an excitation frequency at step S9 is outputted to the above-mentioned drive circuit 20b. As excitation of the above-mentioned batch

object 5 is carried out and it is shown in drawing 5 by this, since the input amplitude based on the input vibration from the above-mentioned engine E side is mostly offset altogether by the above-mentioned excitation amplitude, generating of fluctuation of fluid pressure is controlled and the last amplitude of a liquid column can absorb the fluctuation.

[0024] In the vibrationproofing mounting equipment of the 1st example of the above-mentioned configuration, when large impulse force inputs from the up attachment member 3 side, the elastic bearing object 4 bends greatly and the fluid pressure in up pressurized-room section 12a is raised. In connection with this, elastic support section 7c of the buffer member 7 bends, the variation rate of the substrate section 7b is carried out caudad, thereby, the rise of the above-mentioned fluid pressure is absorbed and the 1st-step buffer of the above-mentioned large impulse force is performed. And since the rise of the above-mentioned fluid pressure extracts and it is transmitted to lower pressurized-room section 12b through hole 7e, thereby, transfer of the above-mentioned fluid pressure is narrowed down and the 2nd-step buffer is performed. For this reason, even if the above-mentioned large impulse force inputs, when it can prevent that that large impulse force carries out a direct action to the batch object 5, the effect to the above-mentioned batch object 5 by the fluid pressure fluctuation which acts can be reduced as much as possible.

[0025] and the above-mentioned 1st setting frequency f1 up to -- when the subsonic vibration by the side of low frequency inputs from the up attachment member 3 side rather than engine shake vibration, as a result of the elastic bearing object's 4 bending and making a pressurized room 12 expand and contract, a flow of Liquid L arises between the balanced rooms 13 through the limit path 17 of the batch object 5. Attenuation of the above-mentioned subsonic vibration can be aimed at by liquid column resonance through the above-mentioned limit path 17 produced by this flow.

[0026] Moreover, the above-mentioned 1st setting frequency f1 It is the 2nd setting frequency f2 greatly. When vibration of a small frequency domain inputs from the above-mentioned up attachment member 3, by the above-mentioned controller 21, a driving means 6 drives and excitation of the batch object 5 is carried out to input vibration compulsorily in phase at the predetermined amplitude. In this case, since the above-mentioned batch object 5 is in phase and excitation is carried out to the above-mentioned input vibration to the lower attachment member 2 by the side of the oscillating receiving part which is the opposite side, it can be displaced relatively in the flow direction and this direction of a liquid produced by the above-mentioned input vibration, and it can decrease the amplitude absorb and act that flow rather than the above-mentioned input amplitude in the up attachment member 3 which vibration inputs. For this reason, the resonance frequency of the liquid column through the limit path 17 changes to a side higher than an original thing (the 1st setting frequency f1), and becomes the frequency of the above-mentioned input vibration, and the corresponding thing.

[0027] That is, the resonance frequency f in the attenuation according [on the simple model of the vibrationproofing mounting equipment shown in drawing 6 and] to liquid column resonance of an internal liquid is the expansion spring constant Ku of the elastic bearing object 4. Spring constant Kb of diaphram 8 Added liquid spring constant Kd It is based on the liquid equivalent mass M of the limit path 17. f= {root (Kd/M)} /2pi .... (1)

It is alike and is expressed more. In addition, the above-mentioned liquid equivalent mass M is expressed by M=(A/a)2 xm based on the effective piston cross section A of a liquid room, the effective sectional area a of the limit path 17, and the amount m of liquid quality in the limit path 17.

[0028] Here, the above-mentioned amount m of liquid quality is expressed by m=axY based on the above-mentioned effective sectional area a and the effective width Y of relative displacement of the vertical direction of the batch object 5. Based on these, f2 ={(a / 4pi2A2) xKd}/Y is obtained by transforming the above-mentioned (1) formula. That is, it is large in the effective width Y of the above-mentioned relative displacement, namely, resonance frequency f becomes small, so that the amplitude of the above-mentioned batch object 5 is enlarged, and resonance frequency f becomes large, so that the above-mentioned amplitude is made small.

[0029] Therefore, above-mentioned f1 <ft <f2 Frequency ft of input vibration of the resonance

frequency of the liquid column which minded the limit path 17 since the amplitude which act on Liquid L by be in phase and carry out compulsion excitation of the batch object 5 to input vibration in the range be made small even to the last amplitude (refer to drawing 4) which subtracted a predetermined excitation amplitude from an input amplitude It change to the high corresponding side. For this reason, attenuation of the above-mentioned input vibration can be aimed at by liquid column resonance through the above-mentioned limit path 17. Thereby, as a continuous line shows to drawing 7 , it is f1 <ft <f2. It can lower from the case of not controlling [which shows the dynamic spring constant of the range in this drawing with an alternate long and short dash line].

[0030] Furthermore, the above-mentioned 2nd setting frequency f2 When the vibration by the side of a RF from which the above-mentioned limit path 17 will be in a blinding condition above inputs from the above-mentioned up attachment member 3 side, excitation is compulsorily carried out with the predetermined excitation amplitude to which the batch object 5 was as in phase as input vibration, and corresponded with the input amplitude by drive control of a driving means 6. Consequently, as a result of negating the input amplitude with the excitation amplitude, the amplitude which acts on Liquid L becomes very few things, for this reason, it can absorb the rise of the fluid pressure in a pressurized room 12, can aim at prevention or control of that fluid pressure rise, and can aim at reduction of transmissibility of vibration. Thereby, it is f2 <=ft. Also in the range by the side of a RF, a dynamic spring constant can be lowered from the case of not controlling, as shown in drawing 7 R> 7, and this can be kept comparatively small.

[0031] The batch object 5 thus, by carrying out forcible excitation according to the frequency and amplitude of input vibration When the equivalent mass of the liquid column through the limit path 17 can be changed, the resonance frequency can be changed according to the above-mentioned input vibration and the liquid column resonance to input vibration of the frequency of arbitration can be obtained, Blinding critical frequency f2 of the above-mentioned limit path 17 Also in the above RF field, a fluid pressure rise is absorbable. The attenuation can be aimed at by this to all the input vibration of the broad frequency domain of low frequency - a RF, and implementation of the reduction in a dynamic spring can be aimed at. And to the input of large impulse force, the fluid pressure fluctuation accompanying that input can be absorbed by the buffer member 7, it can ease, the above-mentioned batch object 5 can be protected, and improvement in endurance of this batch object 5, as a result improvement in the endurance of the whole vibrationproofing mounting equipment can be aimed at.

[0032] The maintenance barrel to which drawing 8 shows the vibrationproofing mounting equipment concerning the 2nd example of this invention to, and 25 holds the batch object 5 possible [sliding of the vertical direction], and 26 are buffer members.

[0033] The above-mentioned maintenance barrel 25 consists of periphery cylinder part material 10, inner circumference cylinder part material 27, and a rubber layer 20 that really connects both by vulcanization adhesion, and the above-mentioned batch object 5 is inner-******(ed) by the inner skin of the above-mentioned inner circumference cylinder part material 27 possible [vertical movement] through O ring 18.

[0034] Bulge section 26b which is the plate-like part material by which the above-mentioned buffer member 26 has an outer diameter slightly smaller than the bore of the support barrel 1, and penetration formation of the drawing hole 26a of the diameter of predetermined was carried out at the mid gear, and the center section is crooked and bulges up is formed. In the location by the side of the inner skin of the support barrel 1 by which periphery edge 26c of this buffer member 26 is arranged Between the upper limit side of the above-mentioned rubber layer 20, and the periphery section lower limit side of the elastic bearing object 4 The hold section 28 of slightly larger vertical spacing than the board thickness of the above-mentioned buffer member 26 is formed, and in this hold section 28, after the above-mentioned periphery edge 26c has allowed backlash movable [a distance slight in the vertical direction], it is held.

[0035] In addition, since the configuration of others of the above-mentioned vibrationproofing mounting equipment is the same as that of the thing concerning the 1st example of the above, it gives the same sign to the same member, and omits the explanation. Therefore, the same drive control as the 1st example is performed by the controller 20 which shows a driving means 6 to

drawing 2 .
[0036] In the 2nd example of the above-mentioned configuration, when large impulse force inputs from the up attachment member 3 side, the elastic bearing object 4 bends greatly and the fluid pressure in up pressurized-room section 12a is raised. In connection with this, the buffer member 26 moves in the vertical direction within the hold section 28, the above-mentioned fluid pressure rise is absorbed, and, thereby, the 1st-step buffer of the above-mentioned large impulse force is performed. Since the rise of the above-mentioned fluid pressure extracts, it is narrowed down through hole 26a and it is moreover transmitted to lower pressurized-room section 12b, thereby, the 2nd-step buffer is performed. For this reason, even if the above-mentioned large impulse force inputs, when it can prevent that that large impulse force carries out a direct action to the batch object 5, the effect by the fluid pressure fluctuation which acts can be reduced as much as possible. Thereby, like the 1st example, even if large impulse force inputs, the fluid pressure fluctuation accompanying that input can be absorbed by the buffer member 26, it can ease, the above-mentioned batch object 5 can be protected, and improvement in endurance of this batch object 5, as a result improvement in the endurance of the whole vibrationproofing mounting equipment can be aimed at. In addition, the effectiveness of the 1st example by the compulsive excitation of the batch object 5 can be acquired similarly.
[0037] Drawing 9 shows the vibrationproofing mounting equipment concerning the 3rd example of this invention, and 25 is a maintenance barrel which holds the batch object 5 possible [sliding of the vertical direction], and has the same configuration as the 2nd example of the above. Moreover, 29 is a buffer member.
[0038] The doughnut-like tie-down plate section 30 which has the outer diameter as the bore of the support barrel 1 with the almost same above-mentioned buffer member 29, The bellows cylinder part 31 made of rubber which was connected with the inner circumference edge of this tie-down plate section 30, and was extended up, It consists of the substrate section 32 which is connected with the upper limit opening edge of this bellows cylinder part 31, and stops that upper limit opening, and penetration formation of the diaphragm hole 32a which opens mutually up pressurized-room section 12a and lower pressurized-room section 12b for free passage in the center section of this substrate section 32 is carried out.
[0039] In addition, since the configuration of others of the above-mentioned vibrationproofing mounting equipment is the same as that of the thing concerning the 1st example of the above, it gives the same sign to the same member, and omits the explanation. Therefore, the same drive control as the 1st example is performed by the controller 20 which shows a driving means 6 to drawing 2 .
[0040] In the 3rd example of the above-mentioned configuration, when large impulse force inputs from the up attachment member 3 side, the elastic bearing object 4 bends greatly and the fluid pressure in up pressurized-room section 12a is raised. Since the above-mentioned fluid pressure acts on the substrate section 32 of the buffer member 29 and the bellows cylinder part 31 expands and contracts in the vertical direction in connection with this, when the above-mentioned fluid pressure rise is absorbed and the 1st-step buffer is performed, since it is transmitted to lower pressurized-room section 12b after the rise of the above-mentioned fluid pressure extracted and having been extracted by hole 32a, thereby, the 2nd-step buffer is performed. For this reason, even if the above-mentioned large impulse force inputs, when it can prevent that that large impulse force carries out a direct action to the batch object 5, the effect by the fluid pressure fluctuation which acts can be reduced as much as possible. Thereby, even if large impulse force inputs, the fluid pressure fluctuation accompanying that input can be absorbed by the buffer member 29, it can ease, the above-mentioned batch object 5 can be protected, and improvement in endurance of this batch object 5, as a result improvement in the endurance of the whole vibrationproofing mounting equipment can be aimed at. In this case, since the above-mentioned buffer member 29 has the bellows cylinder part 31, absorption of the above-mentioned fluid pressure rise can be promoted rather than the case of the 1st or the 2nd example. In addition, the effectiveness of the 1st example by the compulsive excitation of the batch object 5 can be acquired similarly.
[0041] In addition, this invention is not limited to the above 1st - the 3rd example, and includes

various modifications. That is, although it is in contact possible [vertical movement] in the batch object 5 with the maintenance barrels 9 and 25, for example, not only this but the above-mentioned maintenance barrel may be omitted, and you may make it contact possible [vertical movement] directly to the inner skin of the support barrel 1 in each above-mentioned example.
[0042] Moreover, at each above-mentioned example, it is the 1st setting frequency f1. Although the original resonance frequency of the limit path 17 is set up, the frequency (for example, 20Hz) of the idle oscillating field of not only this but an engine may be set up, and excitation control of the batch object 5 may be performed from this idle vibration to the vibration by the side of high frequency.
[0043]
[Effect of the Invention] Since compulsion excitation of the batch object which has a limit path is carried out in the principal-vibration input direction by the driving means according to input vibration according to the vibrationproofing mounting equipment in invention according to claim 1 as explained above, Also as opposed to the high frequency oscillation from which the above-mentioned limit path will be in a blinding condition when the resonance frequency of the liquid column through a limit path can be changed according to input vibration and the liquid column resonance corresponding to the input vibration is obtained The rise of fluid pressure can be effectively absorbed by the above-mentioned compulsion excitation, and reduction of transmissibility of vibration can be aimed at. For this reason, an effective damping effect can be acquired to input vibration of a broad frequency domain.
[0044] Moreover, even if large impulse force tends to act on a pressurized room through an up attachment member and it is going to raise fluid pressure in invention according to claim 2 in addition to the effectiveness by invention of the claim 1 above-mentioned publication, while a buffer member displaces and the rise of the above-mentioned fluid pressure is controlled Since it is transmitted where the rise of fluid pressure is extracted to a batch object side through the drawing hole of the above-mentioned buffer member, It can prevent that the effect of the fluid pressure rise by the above-mentioned large impulse force gets across to the above-mentioned batch object directly, and endurance ****** of this batch object can aim at improvement in the endurance of the whole vibrationproofing mounting equipment.
[0045] Furthermore, in invention according to claim 3, since it has the bellows cylinder part by which the buffer member was extended in the direction of a cylinder axis in addition to the effectiveness by invention of the claim 2 above-mentioned publication, absorption of the fluid pressure rise at the time of large impulse force close [above-mentioned] can be promoted more, and a batch object can be more certainly protected from the above-mentioned large impulse force.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

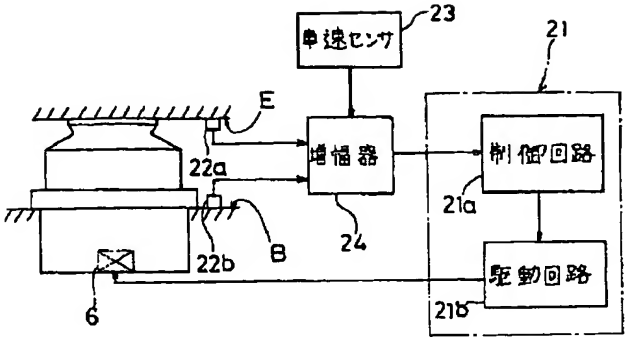
[Brief Description of the Drawings]
[Drawing 1] It is drawing of longitudinal section showing the 1st example of this invention.

[Drawing 2] It is the block diagram showing the configuration which controls a driving means.
[Drawing 3] It is the flow chart which shows the contents of control in a control circuit.
[Drawing 4] input frequency ft f1 <ft -- < -- f2 it is -- it is drawing showing the input amplitude, excitation amplitude, and the last amplitude of a case.
[Drawing 5] input frequency ft f2 <=ft it is -- it is drawing showing the input amplitude, excitation amplitude, and the last amplitude of a case.
[Drawing 6] It is the simple model Fig. of the vibrationproofing mounting equipment of drawing 1 .
[Drawing 7] It is the related Fig. of the frequency of input vibration, and a dynamic spring constant.
[Drawing 8] It is the drawing 1 equivalent Fig. showing the 2nd example.
[Drawing 9] It is the drawing 1 equivalent Fig. showing the 3rd example.
[Description of Notations]
1 Support Barrel
2 Lower Attachment Member (2nd Attachment Member)
3 Up Attachment Member (1st Attachment Member)
4 Elastic Bearing Object
5 Batch Object
6 Driving Means
7, 26, 29 Buffer member
11 Liquid Room
12 Pressurized Room
12a Up pressurized-room section (the 1st pressurized-room section)
12b Lower pressurized-room section (the 2nd pressurized-room section)
13 Balanced Room
17 Limit Path
7e, 26a, 32a Diaphragm hole
31 Bellows Cylinder Part
X Cylinder axis

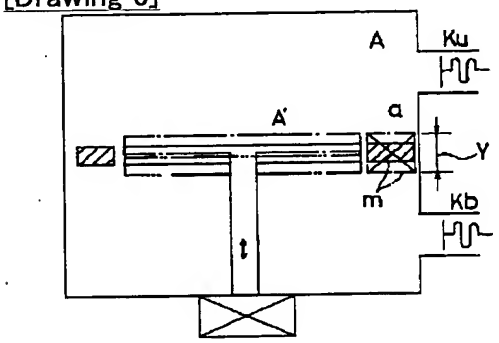
[Translation done.]

DRAWINGS

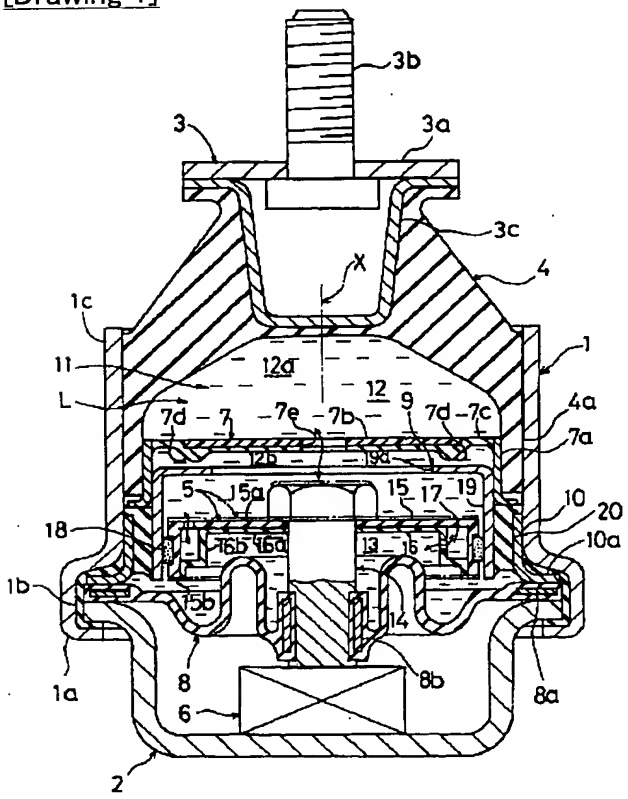
[Drawing 2]



[Drawing 6]



[Drawing 1]



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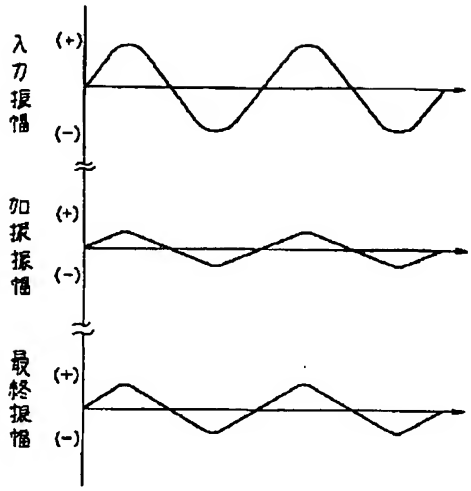
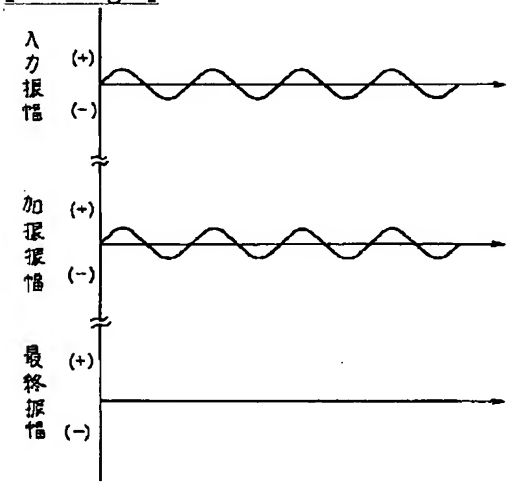
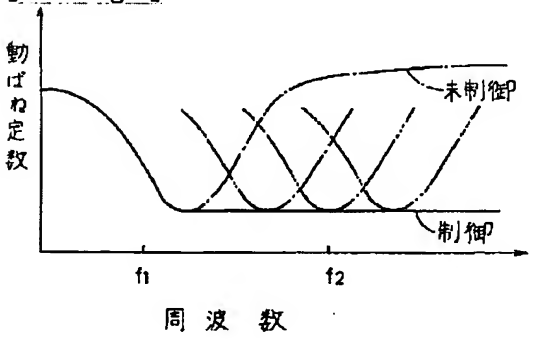


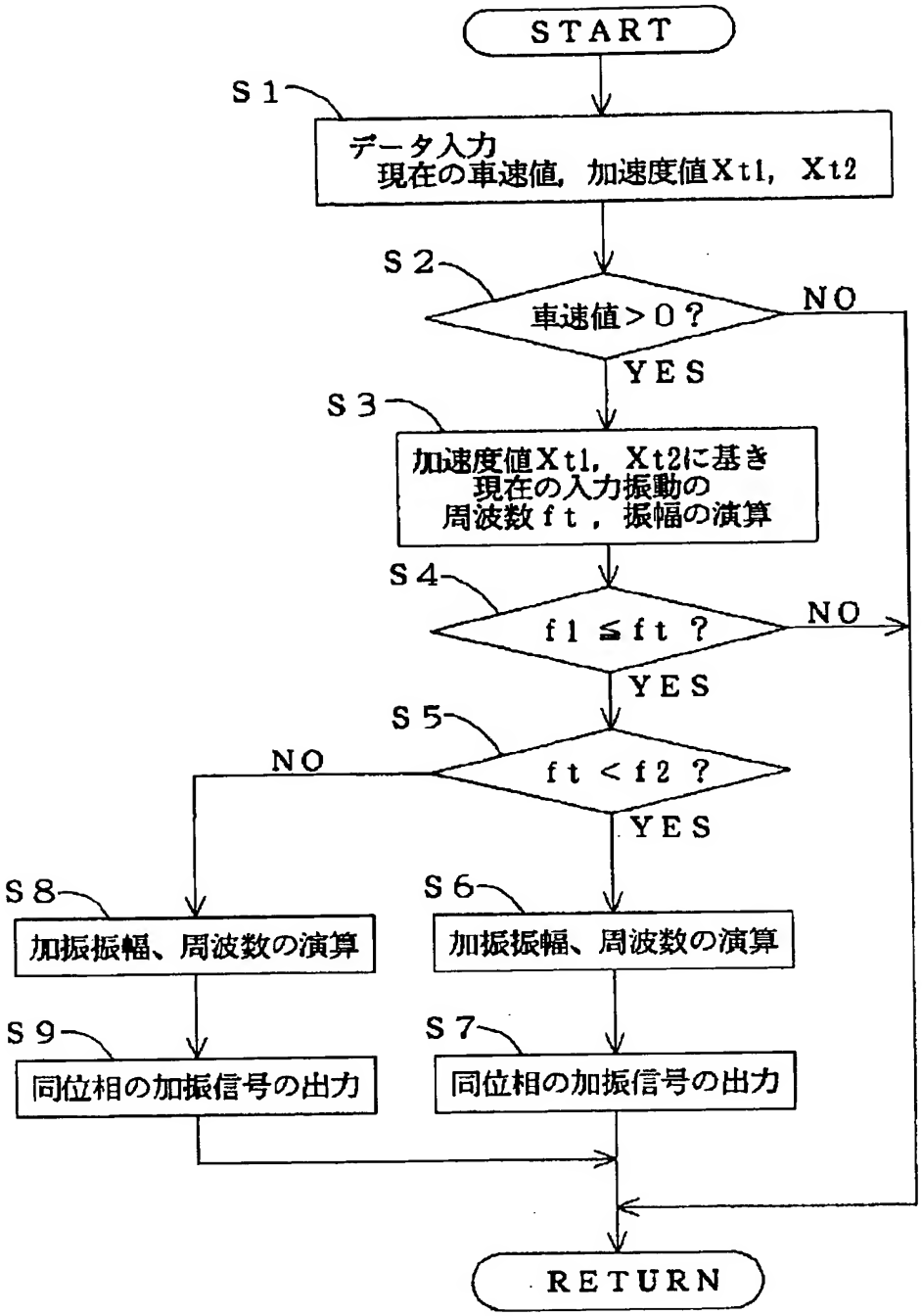
[Drawing 5]



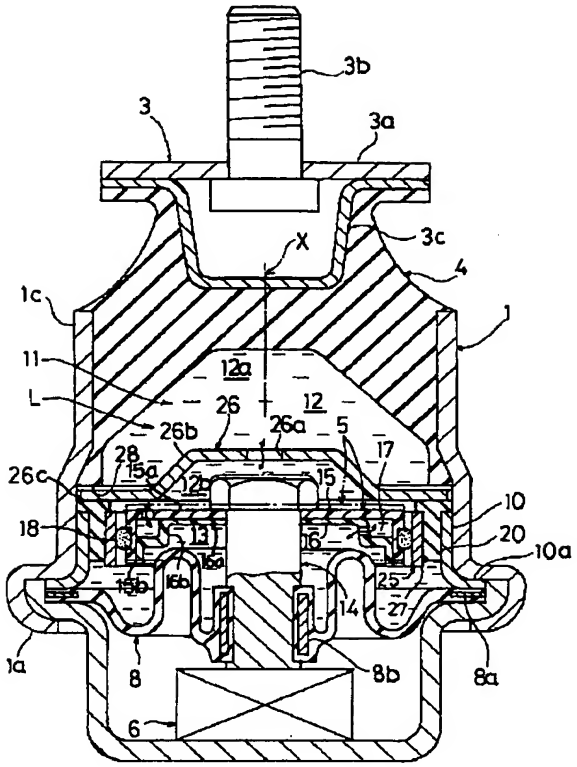
[Drawing 7]



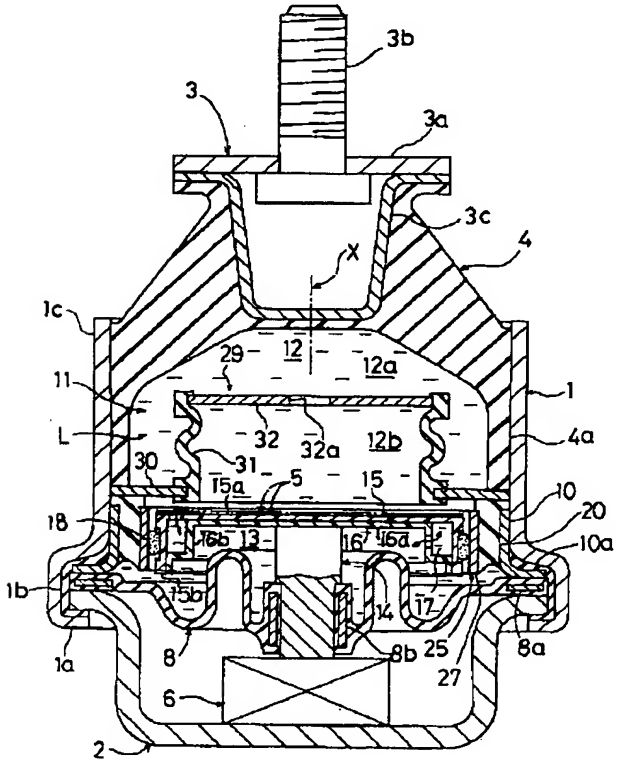
[Drawing 3]


START
S 1
データ入力
現在の車速値，加速度値Xt1，Xt2
S 2
車速値＞0？
NO
YES
S 3
加速度値Xt1，Xt2に基き
現在の入力振動の
周波数ｆｔ，振幅の演算
S 4
f1 ≦ f t ？
NO
YES
S 5
NO
f t ＜ f2 ？
YES
S 8
加振振幅、周波数の演算
S 6
加振振幅、周波数の演算
S 9
同位相の加振信号の出力
S 7
同位相の加振信号の出力
RETURN

[Drawing 8]



[Drawing 9]



[Translation done.]

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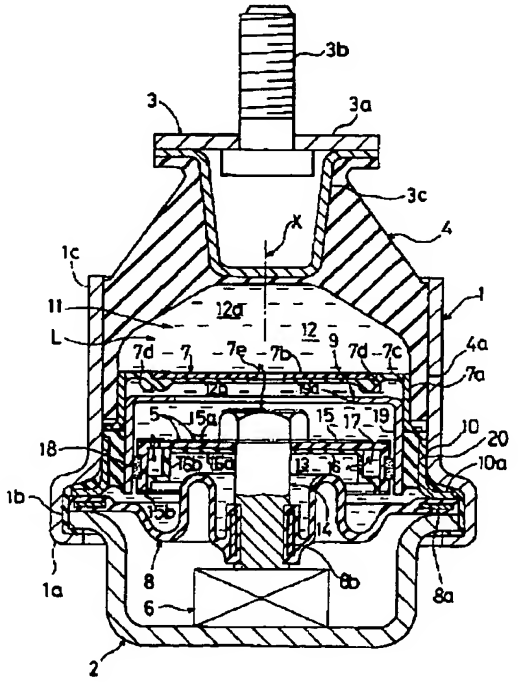
(54)【発明の名称】　防振マウント装置

(57)【要約】

【目的】　幅広い周波数領域の振動を有効に減衰するとともに、大衝撃力の入力時に過大な液圧が仕切体へ作用するのを防止する。

【構成】　上部を振動発生源側に、下部を振動受部側に向けて支持筒体１を配置する。支持筒体と、振動発生源側に連結される上部取付部材３とを弾性支承体４により互いに連結する。振動受部側に連結される下部取付部材２を支持筒体の下部に連結する。弾性支承体と支持筒体とで画成された液室１１に液体Ｌを封入する。液室を加圧室１２と平衡室１３とに仕切る仕切体５を支持筒体に対して上下方向に相対移動可能に配設する。仕切体に、加圧室と平衡室とを互いに連通する制限通路１７を設ける。そして、仕切体を上下方向に入力振動に応じて強制加振する駆動手段６を設ける。また、加圧室を上下に仕切りかつ上下に貫通する絞り孔７ｅを有する緩衝部材７を支持筒体に対して弾性的に支持させて設ける。



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【特許請求の範囲】

【請求項1】　筒軸方向一側端部を振動発生源側に、他側端部を振動受部側にそれぞれ向けて配置される支持筒体と、

この支持筒体の上記一側端部に配置されて上記振動発生源側に連結される第1取付部材と、

この第1取付部材と上記支持筒体の一側端部とを互いに連結する環状の弾性支承体と、

上記支持筒体の上記他側端部に連結されて上記振動受部側に連結される第2取付部材と、

上記弾性支承体と上記支持筒体とにより区画形成されて液体が封入された液室と、

この液室を上記筒軸方向に加圧室と平衡室とに仕切りかつ上記支持筒体の内周面に対して上記筒軸方向に相対移動可能に配置された仕切体と、

この仕切体に設けられて上記加圧室と平衡室とを互いに連通する制限通路と、

上記仕切体を上記筒軸方向に入力振動に応じて強制加振する駆動手段とを備えていることを特徴とする防振マウント装置。

【請求項2】　仕切体と第1取付部材との間の加圧室には、この加圧室を筒軸方向に2つの加圧室部に仕切る緩衝部材が設けられており、

この緩衝部材は支持筒体の内周面に対して加圧室内の液圧変動によって筒軸方向に変位可能に支持されかつこの緩衝部材には上記2つの加圧室部を連通する絞り孔が形成されている請求項1記載の防振マウント装置。

【請求項3】　緩衝部材が筒軸方向に向いたじゃばら筒部を有しており、このじゃばら筒部を介して支持筒体の内周面に支持されている請求項2記載の防振マウント装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、例えば、自動車用エンジンなどのマウントに用いられ、幅広い周波数領域の振動に対して減衰効果を発揮する防振マウント装置に関する。

【0002】

【従来の技術】従来より、この種の防振マウント装置として、振動発生源であるエンジン側に連結される一方の取付部材と、このエンジンを支持する車体側に連結される他方の取付部材との間に画成された液室を、主振動入力方向の中間位置で仕切体によって2つの液室部に仕切り、この2つの液室部を互いに連通する制限通路の開口面積を可変にすることにより、互いに異なる周波数の振動を共に減衰可能としたものが知られている（例えば、特開平1－158243号公報参照）。このものでは、制限通路の開口面積を可変とする手段を上記仕切体に設けられた扇形の開口部と、この仕切体に対して相対回転することにより上記開口部の開口量を変化させる回転プレートとによって構成し、この回転プレートの回転駆動を制御することによって、入力振動の周波数が大きくなる程、上記開口部の開口量が大きくするようになっている。

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【0003】

【発明が解決しようとする課題】ところが、上記従来の防振マウント装置においては、制限通路の開口面積を変化させる手段が開口部と回転プレートとにより構成されているため、開口面積の最小側はともかくとして最大側には制限があり、これにより、高周波側の振動減衰には限界がある。従って、振動減衰の可能な周波数領域をあまり高周波側に設定することができないという問題がある。このため、自動車用エンジンマウント装置として用いる場合、そのエンジン回転数の変動領域が極めて広く、その極めて広い周波数領域で発生する全ての振動を有効に減衰することができないという欠点を有している。また、大衝撃力の入力があった場合、急激な液圧上昇に伴う過大な液圧が上記仕切体に作用して、上記回転プレートの作動の信頼性の低下もしくは仕切体の耐久性の低下を招くおそれがある。

【0004】本発明は、このような事情に鑑みてなされたものであり、その目的とするところは、幅広い周波数領域における全ての振動を有効に減衰することにある。また、他の目的とするところは、大衝撃力の入力時に過大な液圧が仕切体に作用することを防止することにある。

【0005】

【課題を解決するための手段】上記目的を達成するために、請求項1記載の発明は、筒軸方向一側端部を振動発生源側に、他側端部を振動受部側にそれぞれ向けて配置される支持筒体と、この支持筒体の上記一側端部に配置されて上記振動発生源側に連結される第1取付部材と、この第1取付部材と上記支持筒体の一側端部とを互いに連結する環状の弾性支承体と、上記支持筒体の上記他側端部に連結されて上記振動受部側に連結される第2取付部材と、上記弾性支承体と上記支持筒体とにより区画形成されて液体が封入された液室とを備えるものである。このものにおいて、上記液室を上記筒軸方向に加圧室と平衡室とに仕切りかつ上記支持筒体の内周面に対して上記筒軸方向に相対移動可能に配置された仕切体を設け、この仕切体に上記加圧室と平衡室とを互いに連通する制限通路を設ける。そして、上記仕切体を上記筒軸方向に入力振動に応じて強制加振する駆動手段を備える構成とするものである。

【0006】また、請求項2記載の発明は、上記請求項1記載の発明において、仕切体と第1取付部材との間の加圧室に、この加圧室を筒軸方向に2つの加圧室部に仕切る緩衝部材を設ける。そして、この緩衝部材を支持筒体の内周面に対して加圧室内の液圧変動によって筒軸方向に変位可能に支持させかつこの緩衝部材に上記2つの

加圧室部を連通する絞り孔を形成する構成とするものである。

【０００７】さらに、請求項３記載の発明は、上記請求項２記載の発明において、緩衝部材が筒軸方向に向いたじゃばら筒部を有しており、上記緩衝部材を、このじゃばら筒部を介して支持筒体の内周面に支持させる構成とするものである。

【０００８】

【作用】上記の構成により、請求項１記載の発明では、制限通路を有する仕切体が駆動手段によって主振動入力方向に入力振動に応じて強制加振されるため、制限通路を介した液柱の共振周波数が入力振動に応じて変化し、その入力振動に対応した液柱共振が得られる。このため、幅広い周波数領域の入力振動に対して有効な減衰効果が得られる。そして、上記制限通路が目詰まり状態となるような高周波振動に対しても、上記仕切体の強制振動により加圧室内の液圧上昇が抑制されて振動伝達率の低減が図られる。

【０００９】また、請求項２記載の発明では、上記請求項１記載の発明による作用に加えて、第１取付部材を介して第１加圧室部の液圧を上昇させようとしても、緩衝部材が支持筒体の内周面に弾性支持されているためこの緩衝部材が変位して上記液圧の上昇が抑制されるとともに、上記仕切体側である第２加圧室部には上記緩衝部材の絞り孔を介して液圧の変動が絞り込まれた状態で伝達されるため、上記衝撃力による液圧上昇の影響が上記仕切体に直接伝わることがない。

【００１０】さらに、請求項３記載の発明では、上記請求項２記載の発明による作用に加えて、緩衝部材が筒軸方向に延ばされたじゃばら筒部を有しているため、このじゃばら筒部の伸縮により上記大衝撃入力時の液圧上昇の吸収がより促進される。

【００１１】

【実施例】以下、本発明の実施例を図面に基づいて説明する。

【００１２】図１は、本発明の第１実施例に係る防振マウント装置を示し、１は筒軸Ｘが主振動入力方向（図１の上下方向、以下、単に上下方向という）に向いた支持筒体、２はこの支持筒体１の下端開口側を閉止する第２取付部材であるカップ状の下部取付部材、３は上記支持筒体１の上端開口側の位置であって上記筒軸Ｘ上に配置された第１取付部材である上部取付部材、４はこの上部取付部材３と上記支持筒体１とを互いに連結する環状の弾性支承体、５は仕切体、６はこの仕切体５を上下方向に加振駆動する駆動手段、７は上記仕切体５の上方位置を覆う板状の緩衝部材である。

【００１３】上記支持筒体１と下部取付部材２とは、支持筒体１の下端縁部により構成されるかしめ部１ａによって互いに連結されており、これら両者１，２によって有底筒状の支持フレームが構成されている。上記かしめ

部１ａの内周面にはゴム薄膜１ｂが加硫接着されており、このゴム薄膜１ｂによって上記かしめ部１ａにおけるシールが行われるようになっている。また、上記かしめ部１ａには、上記下部取付部材２の外周縁とともにゴム薄膜製のドーナッツ状ダイヤフラム８の外周縁と、保持筒体９を構成する外周筒部材１０の外周縁１０ａとが互いに重ねられた状態で位置固定されており、上記ダイヤフラム８、上記弾性支承体４および支持筒体１により画成された密閉空間に液体Ｌが封入されて液室１１が形成されている。そして、この液室１１が上記仕切体５により２つに仕切られて、加圧室１２がこの仕切体５の上側に、平衡室１３が下側にそれぞれ形成されている。

【００１４】上記支持筒体１または下部取付部材２は図示しないブラケットに内嵌されて上記かしめ部１ａによって外周側に突出する部分で保持されて、振動受部である、例えば車体側に連結されるようになっている。また、上記下部取付部材２の上記平衡室１３の側の面の中央部には上記駆動手段６が設けられており、この駆動手段６に接続されたロッド１４が筒軸Ｘに沿って上記ダイヤフラム８を貫通して上方に延ばされている。そして、このロッド１４の上端位置に上記仕切体５が固定されている。なお、図１中８ａ，８ｂは上記ダイヤフラム８の内外周位置に埋め込まれた芯材であり、外周側芯材８ａによりダイヤフラム８の外周縁が上記かしめ部１ａで確実に保持されるようになっており、また、内周側芯材８ｂにより上記ダイヤフラム８の内周縁が上記ロッド１４の外周面に対して確実に所定位置に固定されるようになっている。

【００１５】上記上部取付部材３は、板部材３ａと、この板部材３ａから上記筒軸Ｘに沿って上方に突出する連結ボルト３ｂと、上記板部材３ａから下方に突出する有底筒部材３ｃとから構成されている。そして、上記連結ボルト３ｂを介して、上記取付部材３は、振動発生源側である、例えばエンジン側に連結されるようになっている。また、上記筒部材３ｃの外周面と上記支持筒体１の上端開口縁１ｃの内周面との間にゴムの一体加硫成形によって上記弾性支承体４が円錐台状に形成されており、この弾性体支承体４によって上記上部取付部材３が上記支持筒体１に対して弾性的に支承されている。なお、この弾性支承体４の下端周縁部から上記支持筒体１の内周面の所定位置までの範囲を被覆するゴム薄膜４ａが一体形成されている。

【００１６】上記仕切体５は、一対の板状部材１５，１６が上下に重ねられて形成されており、外周部の内部に形成された環状の制限通路１７を備えている。すなわち、上記上側板状部材１５が円板部１５ａと、この円板部１５ａの外周縁から下方に垂下する周壁部１５ｂとからなり、また、上記下側板状部材１６が上記円板部１５ａの下面に密着された円板部１６ａと、上記周壁部１５ｂの内周面に相対向する周壁部１６ｂとからなり、この

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周壁部１６ｂの外周囲に形成された環状の凹部によって上記環状の制限通路１７が形成されている。そして、上記制限通路１７の一端が上記加圧室１２に、他端が上記平衡室１３にそれぞれ開口されて、上記加圧室１２および平衡室１３の液体Ｌがこの制限通路１７を通して互いに流動する際の液柱共振により、上下方向に入力する、特に低周波振動の減衰を行うようになっている。また、上記上側板状部材１５の周壁部１５ｂの外周面にはＯリング１８が外嵌されて位置固定されており、このＯリング１８を介して上記仕切体５は上記保持筒体９の内周筒部材１９に対して液密を保持した状態で上下方向に摺動可能に内嵌支持されている。

【００１７】上記保持筒体９はこの内周筒部材１９と、上記外周筒部材１０と、両者を一体加硫接着により連結するゴム層２０とからなり、上記外周筒部材１０の外周縁１０ａがかしめ部１ａにより位置固定されることにより上記内周筒部材１９が上記仕切体５を囲むように配置されている。なお、上記内周筒部材１９の上端縁は内方に屈曲して所定量だけ突出されており、この突出縁１９ａは上記緩衝部材７の後述の凸部７ｄと接触して上記緩衝部材７のそれ以上の下方への変位を阻止するストッパーの役割を果たすようになっている。

【００１８】上記緩衝部材７は、ゴム薄膜４ａを介して支持筒体１の内周面に圧着された取付筒部７ａと、この取付筒部７ａの内径より所定寸法小さい外径を有して上記内周筒部材１９の上方位置に位置付けられた基板部７ｂと、この基板部７ｂと上記取付筒部７ａとを互いに連結する弾性支持部７ｃとから構成されている。この弾性的支持部７ｃは上記取付筒部７ａの上端縁と、基板部７ｂの下面とを加硫接着により一体に連結するものであり、上記基板部７ｂの下面側の外周部位置には下方に突出する凸部７ｄが上記弾性支持部７ｃと一体に形成されている。そして、上記緩衝部材７の中央部には筒軸Ｘ方向に貫通する所定径の絞り孔７ｅが形成されており、この絞り孔７ｅを介して上記緩衝部材７によって仕切られる第１加圧室部である上部加圧室部１２ａと、第２加圧室部である下部加圧室部１２ｂとが互いに連通されている。

【００１９】上記駆動手段６は、例えば電磁アクチュエータもしくは圧電アクチュエータなどにより構成されており、図２に示すように、制御器２１と接続されてこの制御器２１からの制御信号により駆動されて上記ロッド１４および仕切体５を上下方向に所定の振幅および周波数で加振するようになっている。すなわち、上記仕切体５を無段階にかつ正逆に往復運動させるようになっている。上記制御器２１は制御回路２１ａと駆動回路２１ｂとからなり、この制御回路２１ａはエンジンＥの側および車体Ｂの側にそれぞれ設けられた一対の加速度センサ２２ａ，２２ｂおよび車速センサ２３と増幅器２４を介して接続されている。そして、上記制御回路２１ａは、

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上記加速度センサ２２ａ，２２ｂからの加速度検出値および上記車速センサ２３からの車速値とに基づいて上記仕切体５の加振制御すべき振幅および周波数（以下、加振振幅、加振周波数という）を演算し、これらに基く加振信号を入力振動の周波数と同位相で上記駆動回路２１ｂに出力し、この駆動回路２１ｂは上記駆動信号を受けて上記駆動手段６を駆動するようになっている。

【００２０】以下、上記制御回路２１ａでの制御を図３に基いて説明する。この制御はエンジンが始動されることによりスタートされ、まず、ステップＳ１で上記車速センサおよび両加速度センサ２２ａ，２２ｂから現在の車速値と、エンジンＥ側および車体Ｂ側の加速度値Ｘｔ１，Ｘｔ２を入力し、ステップＳ２で検出車速値が０か否かの判別を行う。車速値が０である場合、すなわち、停止している場合はリターンし、走行中である場合はステップＳ３で上記一対の加速度値Ｘｔ１，Ｘｔ２に基いて現在の入力振動の周波数ｆｔおよび振幅（以下、入力周波数，入力振幅という）の演算を行う。

【００２１】次に、ステップＳ４で上記現在の入力周波数ｆｔが第１設定周波数ｆ１以下か否かの判別を行う。この第１設定周波数ｆ１には仕切体５の環状制限通路１７を介した液柱の共振周波数が設定されており、この第１設定周波数ｆ１域の低周波振動（例えば、１１Ｈｚ前後のエンジンシェイク振動より低周波側の７Ｈｚ近傍の振動）の入力に対しては上記制限通路９ｃを介した液柱共振によりその減衰を図るようにしている。このため、上記入力周波数ｆｔが第１設定周波数ｆ１以下場合（ｆｔ≦ｆ１の場合）、制御を行わずにリターンする。

【００２２】そして、上記ステップＳ４で入力周波数ｆｔが上記第１設定周波数ｆ１より大きい場合、ステップＳ５でさらにその入力周波数ｆｔが第２設定周波数ｆ２より小さいか否かの判別を行う。この第２設定周波数ｆ２には、仕切体５の制限通路１７を目詰まり状態とするような高周波側の臨界周波数（例えば３０Ｈｚ）が設定されており、この第２設定周波数ｆ２を境にして異なる制御を行うようにしている。すなわち、上記ステップＳ５で入力周波数ｆｔが第２設定周波数ｆ２より小さい場合（ｆ１＜ｆｔ＜ｆ２の場合）、ステップＳ６で駆動手段６により仕切体５を加振制御するための加振振幅には上記入力振幅より所定量小さい値が定められるようになっており、また、上記加振周波数には入力周波数と同一の値が設定されるようになっている。そして、ステップＳ７で、この加振振幅と加振周波数とに基く加振信号を入力振動と同位相で上記駆動回路２０ｂに出力する。これにより、上記仕切体５が加振されて、図４に示すように、液柱の実質的な相対流動である最終振幅は、上記エンジンＥ側からの入力振動に基く入力振幅から上記加振振幅分打消されて上記入力振幅より所定量小さくされる。つまり、上記緩衝体５の加振によって入力振動を吸収するようになっている。

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【００２３】一方、上記ステップＳ５で入力周波数ｆｔが第２設定周波数ｆ２以上である場合（ｆ２≦ｆｔの場合）、ステップＳ８で、上記ステップＳ６と同様に、加振振幅および加振周波数の演算を行う。この演算は上記入力振動に起因する加圧室１２内の液圧の変動を吸収しうる加振振幅を定めるようになっている。具体的には、加圧室１２の有効ピストン面積に上記入力振幅を乗じたものを仕切体５の有効ピストン面積で除した値を加振振幅として定めればよい。また、上記加振周波数は入力周波数と同一の値を設定する。そして、ステップＳ９でこの加振振幅と加振周波数とに基く加振信号を入力振動と同位相で上記駆動回路２０ｂに出力する。これにより、上記仕切体５が加振されて、図５に示すように、液柱の最終振幅は、上記エンジンＥ側からの入力振動に基く入力振幅が上記加振振幅によってほぼ全て相殺されるため、液圧の変動の発生が抑制されてその変動を吸収することができる。

【００２４】上記構成の第１実施例の防振マウント装置において、上部取付部材３側から大衝撃力が入力した場合、弾性支承体４が大きくたわんで上部加圧室部１２ａ内の液圧を上昇させる。これに伴い、緩衝部材７の弾性支持部７ｃがたわんで基板部７ｂが下方に変位され、これにより、上記液圧の上昇が吸収されて上記大衝撃力の第１段階の緩衝が行われる。そして、上記液圧の上昇が絞り孔７ｅを介して下部加圧室部１２ｂに伝達されるため、これにより、上記液圧の伝達が絞り込まれて第２段階の緩衝が行われる。このため、上記大衝撃力が入力しても、その大衝撃力が仕切体５に直接作用することを防止することができる上、作用する液圧変動による上記仕切体５に対する影響を可及的に低減することができる。

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【００２５】そして、上記第１設定周波数ｆ１までのエンジンシェイク振動よりも低周波側の低周波振動が上部取付部材３側から入力した場合、弾性的支承体４が撓んで加圧室１２を拡縮させる結果、仕切体５の制限通路１７を介して平衡室１３との間で液体Ｌの流動が生じる。この流動により生じる上記制限通路１７を介した液柱共振によって上記低周波振動の減衰を図ることができる。

【００２６】また、上記第１設定周波数ｆ１より大きく第２設定周波数ｆ２より小さい周波数領域の振動が上記上部取付部材３から入力した場合、上記制御器２１によって駆動手段６が駆動されて仕切体５が入力振動と同位相でかつ所定振幅で強制的に加振される。この場合、上記仕切体５は振動が入力する上部取付部材３とは反対側である振動受部側の下部取付部材２に対して上記入力振動と同位相で加振されるため、上記入力振動により生じる液体の流動方向と同方向に相対移動してその流動を吸収し、作用する振幅を上記入力振幅よりも低減することができる。このため、制限通路１７を介した液柱の共振周波数が本来のもの（第１設定周波数ｆ１）よりも高い側に変化して、上記入力振動の周波数と対応したものとなる。

【００２７】すなわち、図６に示す防振マウント装置の簡易モデルにおいて、内部の液体の液柱共振による減衰作用における共振周波数ｆは、弾性支承体４の膨脹ばね定数Ｋｕとダイヤフラム８のばね定数Ｋｂとを加算した液体ばね定数Ｋｄと、制限通路１７の液体等価質量Ｍとに基いて、

$$f = \{\sqrt{(Kd / M)}\} / 2\pi \quad \cdots\cdots (1)$$

により表される。なお、上記液体等価質量Ｍは、液室の有効ピストン断面積Ａと、制限通路１７の有効断面積ａと、制限通路１７内の液質量ｍとに基いて、

$M = (A / a)^2 \times m$

により表される。

【００２８】ここで、上記液質量ｍは、上記有効断面積ａと、仕切体５の上下方向の相対移動の有効幅Ｙとに基いて、

$m = a \times Y$

により表される。これらに基いて、上記（１）式を変形することにより、

$f^2 = \{(a / 4\pi^2 A^2) \times Kd\} / Y$

を得る。つまり、上記相対移動の有効幅Ｙを大きく、すなわち、上記仕切体５の振幅を大きくする程、共振周波数ｆが小さくなり、上記振幅を小さくする程、共振周波数ｆが大きくなる。

【００２９】従って、上記ｆ１＜ｆｔ＜ｆ２の範囲で、仕切体５を入力振動と同位相で強制加振させることにより、液体Ｌに作用する振幅が入力振幅から所定の加振振幅を減じた最終振幅（図４参照）にまで小さくされるため、制限通路１７を介した液柱の共振周波数が入力振動の周波数ｆｔと対応した高い側に変化される。このため、上記制限通路１７を介した液柱共振により上記入力振動の減衰を図ることができる。これにより、図７に実線で示すように、ｆ１＜ｆｔ＜ｆ２の範囲の動ばね定数を同図に一点鎖線で示す未制御の場合より下げることができる。

【００３０】さらに、上記第２設定周波数ｆ２以上で上記制限通路１７が目詰まり状態となるような高周波側の振動が上記上部取付部材３側から入力した場合、駆動手段６の駆動制御により仕切体５が入力振動と同位相でかつ入力振幅と対応した所定の加振振幅で強制的に加振される。この結果、液体Ｌに作用する振幅は、入力振幅が加振振幅により打消される結果、極めてわずかなものとなり、このため、加圧室１２内の液圧の上昇を吸収してその液圧上昇の防止もしくは抑制を図ることができ、振動伝達率の低減を図ることができる。これにより、ｆ２≦ｆｔの高周波側の範囲においても、動ばね定数を、図７に示すように、未制御の場合より下げることができ、これを比較的小さく保つことができる。

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【００３１】このように、仕切体５を入力振動の周波数および振幅に応じて強制加振することにより、制限通路１７を介した液柱の等価質量を変化させることができ、その共振周波数を上記入力振動に応じて変化させて任意の周波数の入力振動に対する液柱共振を得ることができる上、上記制限通路１７の目詰まり臨界周波数ｆ２以上の高周波領域においても液圧上昇を吸収することができる。これにより、低周波～高周波の幅広い周波数領域の入力振動のすべてに対してその減衰を図ることができ、低動ばね化の実現を図ることができる。しかも、大衝撃力の入力に対して、その入力に伴う液圧変動を緩衝部材７によって吸収、緩和して上記仕切体５を保護することができ、この仕切体５の耐久性向上、ひいては、防振マウント装置全体の耐久性の向上を図ることができる。

【００３２】図８は本発明の第２実施例に係る防振マウント装置を示し、２５は仕切体５を上下方向に摺動可能に保持する保持筒体、２６は緩衝部材である。

【００３３】上記保持筒体２５は外周筒部材１０と、内周筒部材２７と、両者を一体加硫接着により連結するゴム層２０とから構成されており、上記内周筒部材２７の内周面に上記仕切体５がＯリング１８を介して上下動可能に内嵌支持されている。

【００３４】上記緩衝部材２６は支持筒体１の内径よりわずかに小さい外径を有しかつ中央位置に所定径の絞り孔２６ａが貫通形成された板状部材であり、その中央部が屈曲されて上方に膨出する膨出部２６ｂが形成されている。この緩衝部材２６の外周縁部２６ｃが配置される支持筒体１の内周面側の位置には、上記ゴム層２０の上端面と、弾性支承体４の外周部下端面との間に、上記緩衝部材２６の板厚よりわずかに大きい上下間隔の収容部２８が形成されており、この収容部２８内に上記外周縁部２６ｃが上下方向にわずかの距離だけ移動可能に、すなわち、がたを許した状態で保持されている。

【００３５】なお、上記防振マウント装置のその他の構成は上記第１実施例に係るものと同一であるため、同一部材には同一符号を付してその説明を省略する。従って、駆動手段６は、図２に示す制御器２０によって第１実施例と同様の駆動制御が行われるようになっている。

【００３６】上記構成の第２実施例において、上部取付部材３側から大衝撃力が入力した場合、弾性支承体４が大きくたわんで上部加圧室部１２ａ内の液圧を上昇させる。これに伴い、緩衝部材２６が収容部２８内で上下方向に移動して上記液圧上昇が吸収され、これにより、上記大衝撃力の第１段階の緩衝が行われる。その上、上記液圧の上昇が絞り孔２６ａを介して絞り込まれて下部加圧室部１２ｂに伝達されるため、これにより、第２段階の緩衝が行われる。このため、上記大衝撃力が入力しても、その大衝撃力が仕切体５に直接作用することを防止することができる上、作用する液圧変動による影響を可及的に低減することができる。これにより、第１実施例

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と同様に、大衝撃力が入力しても、その入力に伴う液圧変動を緩衝部材２６によって吸収、緩和して上記仕切体５を保護することができ、この仕切体５の耐久性向上、ひいては、防振マウント装置全体の耐久性の向上を図ることができる。なお、仕切体５の強制加振による第１実施例の効果をも同様に得ることができる。

【００３７】図９は本発明の第３実施例に係る防振マウント装置を示し、２５は仕切体５を上下方向に摺動可能に保持する保持筒体であって、上記第２実施例と同様の構成を有している。また、２９は緩衝部材である。

【００３８】上記緩衝部材２９は支持筒体１の内径とほぼ同じ外径を有するドーナッツ状の取付板部３０と、この取付板部３０の内周縁に連結されて上方に延ばされたゴム製のじゃばら筒部３１と、このじゃばら筒部３１の上端開口縁に連結されてその上端開口を閉止する基板部３２とからなり、この基板部３２の中央部に上部加圧室部１２ａと下部加圧室部１２ｂとを互いに連通する絞り孔３２ａが貫通形成されている。

【００３９】なお、上記防振マウント装置のその他の構成は上記第１実施例に係るものと同一であるため、同一部材には同一符号を付してその説明を省略する。従って、駆動手段６は、図２に示す制御器２０によって第１実施例と同様の駆動制御が行われるようになっている。

【００４０】上記構成の第３実施例において、上部取付部材３側から大衝撃力が入力した場合、弾性支承体４が大きくたわんで上部加圧室部１２ａ内の液圧を上昇させる。これに伴い、緩衝部材２９の基板部３２に上記液圧が作用してじゃばら筒部３１が上下方向に伸縮するため、上記液圧上昇が吸収されて第１段階の緩衝が行われる上、上記液圧の上昇が絞り孔３２ａによって絞られた状態で下部加圧室部１２ｂに伝達されるため、これにより、第２段階の緩衝が行われる。このため、上記大衝撃力が入力しても、その大衝撃力が仕切体５に直接作用することを防止することができる上、作用する液圧変動による影響を可及的に低減することができる。これにより、大衝撃力が入力しても、その入力に伴う液圧変動を緩衝部材２９によって吸収、緩和して上記仕切体５を保護することができ、この仕切体５の耐久性向上、ひいては、防振マウント装置全体の耐久性の向上を図ることができる。この場合、上記緩衝部材２９がじゃばら筒部３１を有しているため、上記液圧上昇の吸収を第１もしくは第２実施例の場合よりも促進することができる。なお、仕切体５の強制加振による第１実施例の効果をも同様に得ることができる。

【００４１】なお、本発明は上記第１～第３実施例に限定されるものではなく、その他種々の変形例を包含するものである。すなわち、上記各実施例では、仕切体５を保持筒体９，２５により上下動可能に接触しているが、これに限らず、例えば、上記保持筒体を省略して支持筒体１の内周面に対して直接に上下動可能に接触させても

よい。

【００４２】また、上記各実施例では、第１設定周波数ｆ１に制限通路１７の本来の共振周波数を設定しているが、これに限らず、例えばエンジンのアイドル振動領域の周波数（例えば２０Ｈｚ）を設定し、このアイドル振動より高周波数側の振動に対して仕切体５の加振制御を行ってもよい。

【００４３】

【発明の効果】以上説明したように、請求項１記載の発明における防振マウント装置によれば、制限通路を有する仕切体が駆動手段によって主振動入力方向に入力振動に応じて強制加振されるため、制限通路を介した液柱の共振周波数を入力振動に応じて変化させることができ、その入力振動に対応した液柱共振が得られる上、上記制限通路が目詰まり状態となる高周波振動に対しても、上記強制加振により液圧の上昇を有効に吸収して振動伝達率の低減を図ることができる。このため、幅広い周波数領域の入力振動に対して有効な減衰効果を得ることができる。

【００４４】また、請求項２記載の発明では、上記請求項１記載の発明による効果に加えて、上部取付部材を介して加圧室に大衝撃力が作用して液圧を上昇させようとしても、緩衝部材が変位して上記液圧の上昇が抑制されるとともに、仕切体側には上記緩衝部材の絞り孔を介して液圧の上昇が絞られた状態で伝達されるため、上記大衝撃力による液圧上昇の影響が上記仕切体に直接伝わるのを防止することができ、この仕切体の耐久性ひいては防振マウント装置全体の耐久性の向上を図ることができる。

【００４５】さらに、請求項３記載の発明では、上記請求項２記載の発明による効果に加えて、緩衝部材が筒軸方向に延ばされたじゃばら筒部を有しているため、上記大衝撃力入時の液圧上昇の吸収をより促進することができ、上記大衝撃力から仕切体をより確実に保護すること

ができる。

【図面の簡単な説明】

【図１】本発明の第１実施例を示す縦断面図である。

【図２】駆動手段の制御を行う構成を示すブロック図である。

【図３】制御回路での制御内容を示すフローチャートである。

【図４】入力周波数ｆｔがｆ１＜ｆｔ＜ｆ２である場合の入力振幅、加振振幅および最終振幅を示す図である。

【図５】入力周波数ｆｔがｆ２≦ｆｔである場合の入力振幅、加振振幅および最終振幅を示す図である。

【図６】図１の防振マウント装置の簡易モデル図である。

【図７】入力振動の周波数と動ばね定数との関係図である。

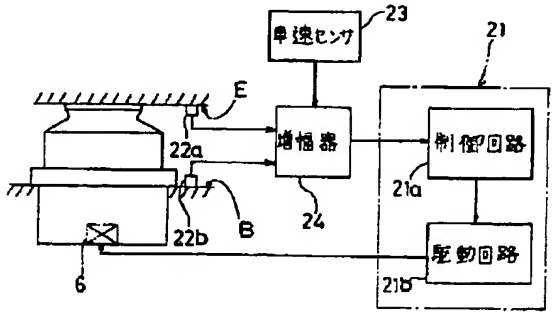
【図８】第２実施例を示す図１相当図である。

【図９】第３実施例を示す図１相当図である。

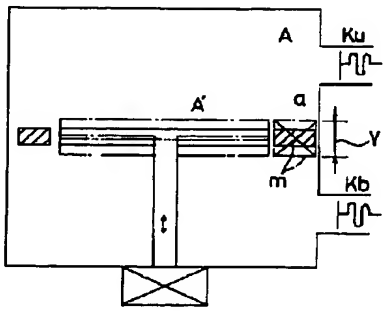
【符号の説明】

１　支持筒体
２　下部取付部材（第２取付部材）
３　上部取付部材（第１取付部材）
４　弾性支承体
５　仕切体
６　駆動手段
７，２６，２９　緩衝部材
１１　液室
１２　加圧室
１２ａ　上部加圧室部（第１加圧室部）
１２ｂ　下部加圧室部（第２加圧室部）
１３　平衡室
１７　制限通路
７ｅ，２６ａ，３２ａ　絞り孔
３１　じゃばら筒部
Ｘ　筒軸

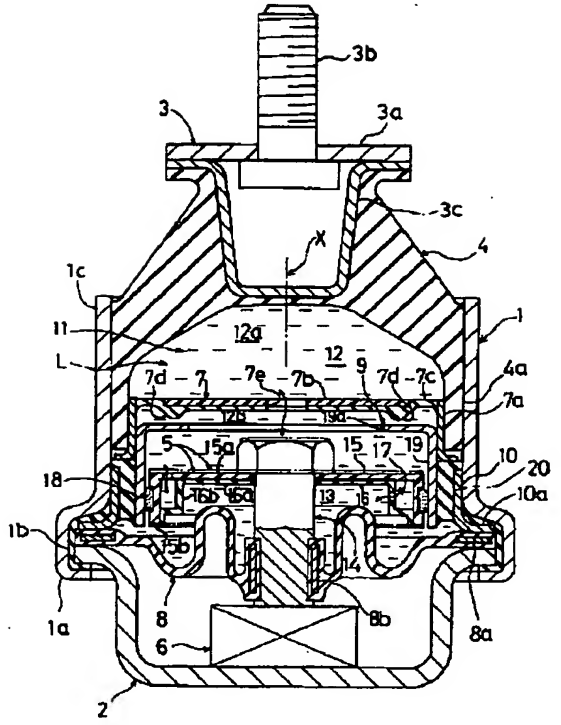
【図２】



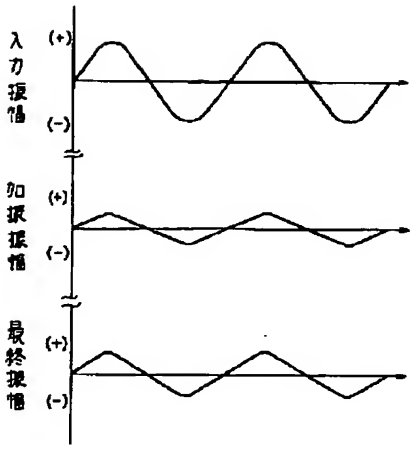
【図６】



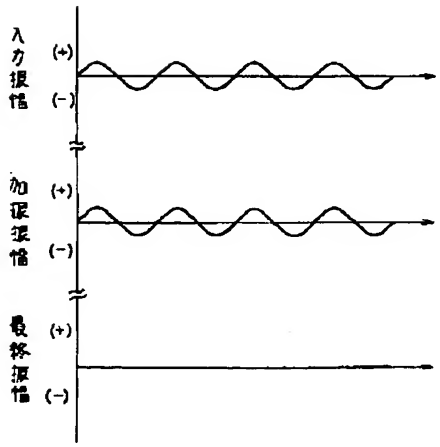
【図1】


3b
3
3a
3c
X
4
1c
11
12a
12
L
9
1
4a
7a
5
15a
15
17
19
10
20
18
10a
1b
1a
8
8b
8a
6
2

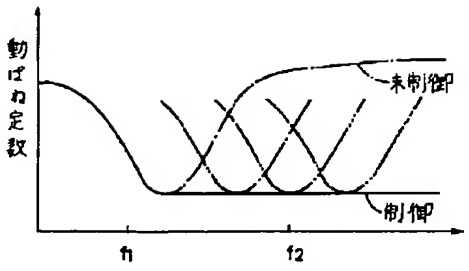
【図4】


入力振幅
(+)
(−)
加振振幅
(+)
(−)
最終振幅
(+)
(−)

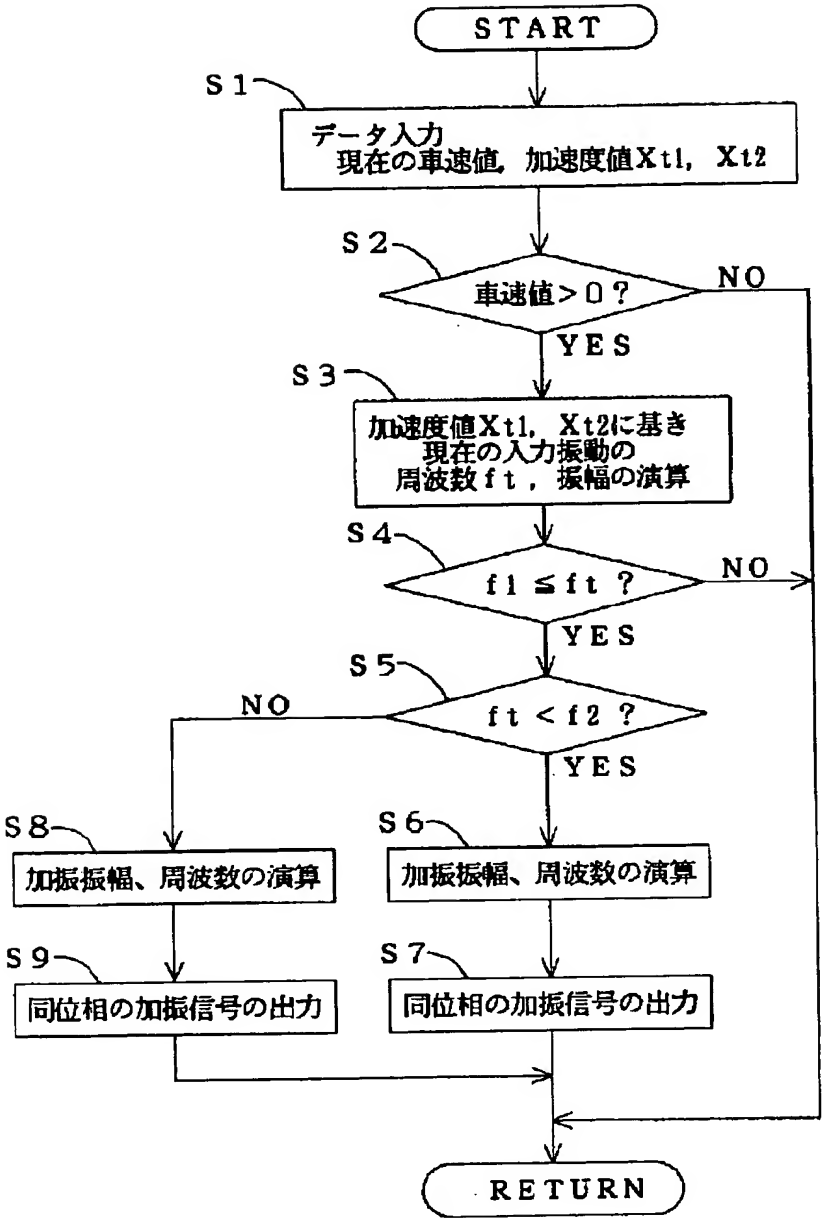
【図5】


入力振幅
(+)
(−)
加振振幅
(+)
(−)
最終振幅
(+)
(−)

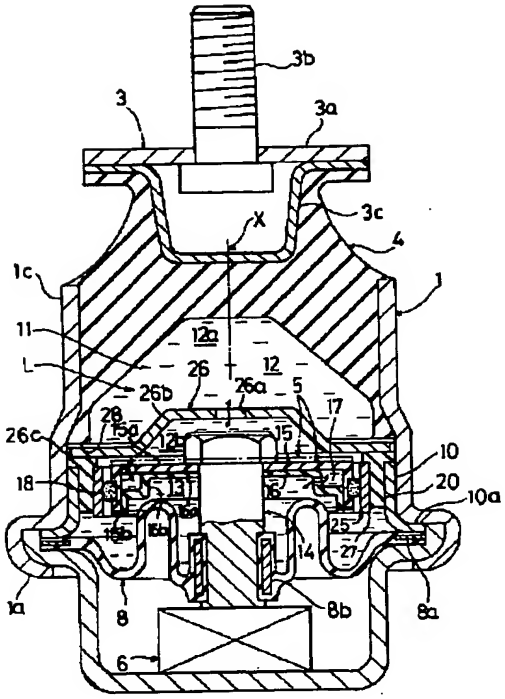
【図7】


動ばね定数
未制御
制御
f1
f2
周波数

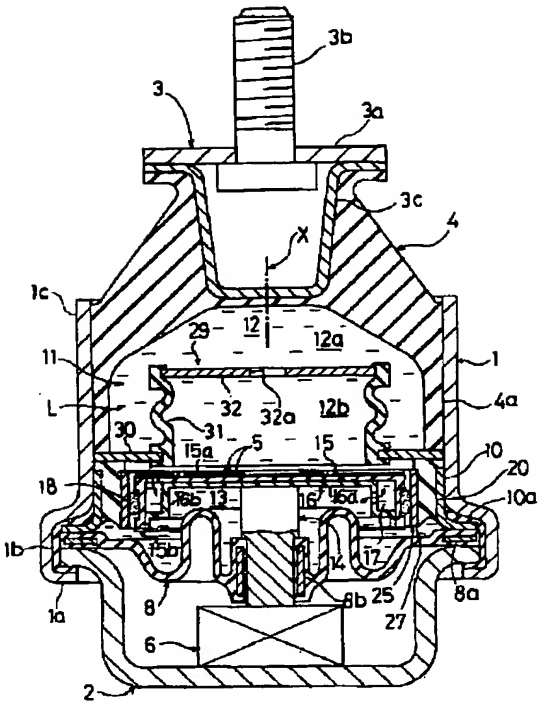
【図3】


START
S1
データ入力
現在の車速値，加速度値Xt1，Xt2
S2
車速値＞0？
NO
YES
S3
加速度値Xt1，Xt2に基き
現在の入力振動の
周波数ft，振幅の演算
S4
f1 ≦ ft ？
NO
YES
S5
NO
ft ＜ f2 ？
YES
S8
加振振幅、周波数の演算
S6
加振振幅、周波数の演算
S9
同位相の加振信号の出力
S7
同位相の加振信号の出力
RETURN

【図8】


3b
3
3a
3c
X
4
1c
1
11
12a
L
26
12
26b
26a
5
17
28
15a
26c
15
10
18
20
10a
16
25
14
27
16b
8
8b
8a
1a
6

【図9】


3b
3
3a
3c
X
4
1c
29
12
12a
1
11
L
32
32a
12b
4a
30
31
15a
5
15
10
18
20
10a
16
16a
13
1b
15b
14
17
8
8b
25
27
8a
1a
6
2